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The PermaNET project: a multi-disciplinary approach to map permafrost and assess related mass-movements.

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Permafrost is highly sensitive to climatic changes and its degradation and related natural hazards affect traffic routes, tourism areas, settlements and infrastructures. The PermaNET (Permafrost long-term monitoring network) project is a program co-funded by the European Regional Development Found that aims at preventing permafrost-related hazards, contributing to sustainable territorial development and implementing good governance practices. Within this project and with the support of the European Space Agency, the Veneto Region (Italy), together with ARPAV (Veneto Region Agency for the Protection of the Environment) and IRPI (Research Institute for Hydrogeological Hazard Prevention) is carrying out studies on high mountains areas (more than 2000 meters in elevation) of the province of Belluno (Italy) to assess the presence of permafrost and evaluate its degradation over the last 20 years. The poster shows the preliminary results obtained using a multi-disciplinary approach that has been tested over an area of 72 km2 of the Cordevole River basin (Italian Dolomites) that aims to map and assess permafrost-related mass movements. The integrated methodology includes three different disciplines such as geomorphology, radar remote sensing, in particular differential interferometry techniques (DInSAR), which coupling the advantages of remote sensing techniques with the accuracy of geodetic measurements, represent the only tool capable to monitor small terrain deformations over large inaccessible areas, and glacial and periglacial modeling. The first step of this approach has consisted in the identification and zonation of permafrost-related mass movements conducted through a geomorphological interpretation of aerial orthophotographs collected in 2006. A 17 years-long DInSAR (Differential Interferometry) analysis, that has exploited the ESA ERS and ENVISAT images archives from 1992 to 2009, has then been performed in order to detect and measure surface displacements. Areas that have undergone deformations have been superimposed to the disruptions mapped by the previous analysis in order to define regions potentially affected by permafrost and related natural hazards. Finally the results obtained have been used to validate a spatially distributed three dimensional model for analysing and predicting dynamics of snow-dominated surface processes in mountainous topography devoleped by the other partners of the PermaNET project. This integrated approach aims to lead to the joint development of a common strategy for dealing with permafrost and related hazards under changing climatic conditions and the creation of an Alpine-wide monitoring network.